Specifications for WR-A4271

Install Drum Heaters on Boilers, Building 24

December 1, 2004

National Aeronautics and
Space Administration
Goddard Space Flight Center
Greenbelt, Maryland
20771

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SECTION 01010

SUMMARY OF WORK

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SECTION 01010

SUMMARY OF WORK
1/02

PART 1 GENERAL

1.1 SUMMARY (Not Applicable)

1.2 REFERENCES

The publications listed below form a part of this section to the extent referenced:

GODDARD SPACE FLIGHT CENTER (GSFC)

GSFC GHB 1600.1A	(1990) Goddard Space Flight Center Security Manual

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals", in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Mobilization Plans

Utility Outage Plan

1.4 NORMAL DUTY HOURS

Normal duty hours for work shall be from 7:00 a.m. to 3:00 p.m. in Buildings 24, 24A, 24B, 24C, and 31.

Work shall be performed only during normal duty hours, except as otherwise required or authorized by the Contracting Officer, or where such timeliness of performance is necessary to safeguard life or property.

Requests for deviation from normal working hours shall be submitted in writing to the Contracting Officer not less than 3 working days in advance of the proposed work period.

1.5 OCCUPANCY OF PREMISES

The work area will be occupied, and operational, during performance of work under this Contract. The Contractor shall take particular care when working in the Central Power Plant. Uninterrupted operation must be maintained in these areas.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION

3.1 CONTRACTOR MOBILIZATION

Before work is started, the Contractor shall submit to the Contracting Officer a Mobilization Plan, indicating locations of office and storage trailers, staging areas, means of access to work areas, and use of approaches, corridors, and stairways.

3.2 PERSONNEL AND VEHICULAR PASSES

Personnel and vehicular passes shall be obtained in accordance with GSFC GHB 1600.1A.

3.3 UTILITY OUTAGES AND CONNECTIONS

For work that involves utility outages, the Contractor shall submit a Utility Outage Plan. The Utility Outage Plan shall list all significant outages that will be necessary in the project to complete the work. The Contractor shall utilize the Outage Table shown on the Drawings as the basis for this plan, and other information which may be provided by the Government. The Utility Outage Plan shall include proposed dates/durations of outages, and it shall be updated periodically as necessary to keep current with the revisions to the work schedule.

For sprinkler and smoke outage requests, the Contractor shall request at least 3 working days in advance of the proposed outage (see Section 01411, "General Safety Requirements" for additional information. For all other outage requests, the Contractor shall request at least 7 working days in advance of the proposed outage.

Utility outages and connections required during the prosecution of work that affect existing systems shall be arranged for at the convenience of the Government and shall be scheduled outside the regular working hours, or on weekends, as directed by the Contracting Officer or his designated Technical Representative.

Contractor shall not be entitled to additional payment for utility outages and connections required to be performed outside the regular work hours or on weekends.

Work shall be scheduled to minimize utility outages. When the work involves more than one connection to an existing utility, all connections to that utility shall be scheduled and made during a single utility outage. Contractor shall provide sufficient work force to accomplish all scheduled outage work during the approved outage period.

Should the Contractor request Outages for which the Government dutifully processes and expends man hours in preparing the Outage for the Contractor's use, and for which the Contractor then neglects to utilize the Outage, the Government may elect to deduct a compensatory value from the contract price, equal to the value of preparing the Outage.

3.4 PERMITS

Contractor shall secure permits for hot work, and for work in confined spaces. All requests shall be made in writing to the Construction Inspector, using the appropriate form. No work shall be performed until an

approved permit has been obtained and posted.

Permits shall be posted at a conspicuous location in the construction area.

3.4.1 Hot Work Permits

Contractor shall request a Hot Permit not less than 3 working days prior to the proposed hot work. See Section 01411, "General Safety Requirements" for additional details.

Notwithstanding issuance of any permit, the Contractor shall not burn trash or rubbish on the Goddard Space Flight Center.

3.4.2 Confined Space Entry Permits

Contractor shall request a Confined Space Entry Permit not less than 3 working days prior to the proposed confined space entry. See Section 01411, "General Safety Requirements" for additional details.

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SECTION 01200

PROJECT MANAGEMENT

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SECTION 01200

PROJECT MANAGEMENT
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PART 1 GENERAL

1.1 SUMMARY

The requirements of this section apply to, and are a component part of, each section of the specifications.

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

A Progress Schedule shall be submitted within 15 days of Notice to Proceed.

SD-07 Certificates

Progress Reports reflecting the current status of the work shall be submitted at the first project meeting of each month. When no project meetings are scheduled for a given month, progress reports shall be submitted before the 15th of that month.

SD-11 Closeout Submittals

As-Built Drawings
Operation and Maintenance Manuals

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 PRECONSTRUCTION CONFERENCE

Contractor shall attend a preconstruction conference when scheduled by the Contracting Officer or their designee. Work shall not commence prior to the conference. Subcontractor representatives shall attend.

Discussion shall address project orientation, personnel contact, safety issues, security issues, permits, deficiencies, progress meetings, progress schedule submittal, submittal schedule submittal, as-built drawings, and the location of the Contractor's office.

3.2 PROGRESS MEETINGS

Contractor shall attend periodic progress meetings scheduled by the Government. Attendance shall include the appropriate staff members and

subcontractors to address scheduled agenda topics for each meeting, and as directed by the Contracting Officer.

Meeting agenda will include the review of minutes of previous meeting, work progress, field observations, problems, decisions, status of submittals, status of progress schedule, potential factors of delay, deficiencies, material delivery schedules, safety issues, as-built drawings, and other business relating to the work.

Updates of the progress/submittal schedules shall be submitted monthly, and reviewed at progress meetings as necessary.

3.2.1 As-Built Drawings

Contractor shall maintain one set of As-Built Drawings. As-Built Drawings shall be kept current throughout the progress of work. As-Built Drawings shall incorporate all contract changes and deviations.

Mark-ups shall be made consistent with the following color scheme:

Red = Deletions
Blue = Additions
Green = Relocations/Corrections/Substitutions

The drawings shall also indicate the Government administrative number incorporating or approving the change or deviation.

Marks made by the Contractor shall be sharp, clear, and legible. Mark-ups shall be drawn to the scale of the original drawing.

Contractor shall not conceal any work until after actual field conditions have been recorded on the As-Built Drawings.

As-Built Drawings shall be presented at Progress Meetings for review by the Government.

Failure by Contractor to accurately reflect current information on the As-Built Drawings may result in determination by Contracting Officer that Contractor has failed to meet his Progress Schedule. Payment, or a portion of the payment, including final payment, may be withheld until the As-Built Drawings are current, and accepted by the Contracting Officer.

3.3 PROGRESS SCHEDULE

The Contractor shall submit and maintain a progress schedule.

After government approval, the Contractor shall maintain, update, and resubmit the schedule on a monthly basis, and whenever a change to the contract occurs.

3.3.1 Format

Include no less than the following information on the progress schedule:

(1) Break out by major headings for primary work activity.

(2) A line item break out under each major heading sufficient to track the progress of the work.

(3) Line items showing contract ending tasks for operational readiness reviews, O&M Manuals, punch list, final clean-up, and submission of As-Built Drawings.

3.3.2 Anticipated Adverse Weather Days

The Contractors schedule shall reflect the following anticipated adverse weather delays on all weather dependent activities.

Monthly Anticipated Adverse Weather Calendar Days

J	F	M	A	M	J	J	A	S	O	N	D
4	4	4	5	5	2	2	3	2	3	4	4

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01330

SUBMITTALS

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SECTION 01330

SUBMITTALS
1/02

PART 1 GENERAL

1.1 SUMMARY

The requirements of this section apply to, and are a component part of, each section of the specifications.

1.2 SUBMITTALS

A standard transmittal form provided by the Government shall be used to transmit each submittal.

Submittal Description (SD): Drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials to be furnished by the Contractor explaining in detail specific portions of the work required by the contract.

The following items, SD-01 through SD-11, are descriptions of data to be submitted for the project. The requirements to actually furnish the applicable items will be called out in each section.

SD-01 Preconstruction Submittals

Submittals, which are required at the outset of the basic contract, or upon award of contract option or similar work breakdown, generally administrative, schedule, and/or project management oriented in content.

SD-02 Shop Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, single line diagrams, detail of fabrications, layout of particular elements, connections, and other relational aspects of the work.

SD-03 Product Data

Submittals composed of manufacturer's standard catalog cuts, brochures, circulars, specifications and product data, and other pre-printed non-project specific information. Such information shall be clearly marked as to product data that is specific to the work, including indication of specific type, size, optional features, etc., which are submitted.

Submittals may also include non-preprinted, project specific information such as equipment schedules, computerized sizing/selection data, and specific performance data or curves.

SD-04 Samples

Submittals including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-06 Test Reports

Submittals of reports (laboratory, factory, or field as specified) of findings of product performance/characteristics providing a basis for determination that the products perform, or are installed in accordance with all other submittals, manufacturer's requirements, and work performance specifications. Report must be signed by an authorized official of a testing laboratory or agency, must state the test results, and indicate whether the result is pass or fail.

SD-07 Certificates

Submittals comprising a document verifying individual or company licensing, compliance with industry recognized qualifications standards, or similar. Document shall show applicable seal or other marking of the approving licensing organization; or

Submittals comprising statements signed by responsible officials (manufacturer, installer, tester) attesting that the work (material, installation, or configuration) meets specified requirements. Statements must be dated after the award of this contract, name the project, and list the specific requirements that it is intended to attest.

Certain submittals provided on a daily or other routine basis that do not require submission to the A-E of Record. These submittals are provided directly to the Government only at the location, quantity, and format specified. Examples include Daily Reports, Hot Work/Confined Space/Excavation Requests.

SD-10 Operation and Maintenance Data

Submittals comprising information intended to be incorporated into an operations and maintenance manual.

SD-11 Closeout Submittals

Submittals, which are required at the closeout of the contract, or portions of the contract work to be partially accepted, such as as-built drawings, punch list documentation completion, final invoice, release of lien, etc.

1.3 PREPARATION

1.3.1 Transmittal Form Format

Transmittal forms shall utilize GSFC form FMD-304 Material Approval Submittal Transmittal identifying the Contractor, his address, and telephone number, contract number, and date of submission. Each individual submittal shall be marked on the transmittal form, and shall be identified by submittal schedule reference number (i.e., NASA NUMBER if provided); Subcontractor and supplier, their addresses and telephone numbers; submittal name; contract specification and drawing reference; compliance with applicable referenced specifications; and similar information to distinguish it from other submittals.

1.3.2 Drawing Format

Drawing submittals shall be prepared on sheets not less than 8-1/2 x 11 inches nor larger than 30 x 42 inches in size, except for full size patterns or templates. Drawings shall be prepared to accurate size, with scale indicated, unless other form is required. Drawings shall have dark lines on a white or translucent background.

Copies of each drawing shall have the following information clearly marked thereon:

a. The job name, which shall be the general title of the contract drawings.

b. Name of Contractor.

c. Name of Subcontractor.

d. The date of the drawings and revisions.

e. The name of the item, material, or equipment detailed thereon.

f. The number of the submittal (e.g., first submittal, etc.) in a uniform location adjacent to the title block.

Drawings shall be numbered in sequence. Contractor may use his own number system. Each drawing shall bear the number of the submittal in a uniform location adjacent to the title block. The Government contract number shall appear in the title block, for each drawing.

1.3.3 Data Format

Required data submittals for each specific material, product, unit of work, or system shall be collected into a single submittal and marked for choices, options, and portions applicable to the submittal. Marking of each copy of product data submitted shall be identical. Partial submittals will not be accepted for expedition of construction effort.

1.4 SUBMISSION REQUIREMENTS

1.4.1 Drawings Submittals

Drawings shall be suitable for electronic scanning, and reproduction on Xerographic process machines, and shall be of a quality to produce clear, distinct lines and letters.

7 total blackline or blueline prints of each drawing shall be submitted to the Government. 3 prints, marked with review notations by the Government, shall be returned to the Contractor.

1.4.2 Data Submittals

Data shall be suitable for microfilming, scanning, and reproduction on Xerographic process machines, and shall be of a quality to produce clear, distinct lines and letters. Data shall be indexed and bound, and shall be the manufacturer's standard product data.

7 total blackline prints of each data page shall be submitted to the

Government. 3 copies, marked with review notations by the Government, shall be returned to the Contractor.

1.4.2.1 Final Submissions of Drawing and Data Submittals

Final submissions of Drawing and Data submittals shall be in electronic format, Microsoft Office 97 (copyrighted) products, AutoCADD R14 (copyrighted), or later releases. Submission shall be on CD-R format. Electronic submissions shall comply with FMD CADD Manual.

1.4.5 Variations and Substitutions

Variations and substitutions shall be clearly stated as such in the transmittal letters and on the shop drawings, data, or samples. Failure to point out and identify deviations may result in the rejection and removal of such work at no additional cost to the Government. All deviations are subject to Government approval.

Where the Contractor proposes to substitute materials, the Contractor shall submit 2 samples of material specified and 2 samples of material proposed for substitution, along with sufficient technical information, including test reports or other supporting information if so required by the Contracting Officer to show equality to products specified, on each item at variance with the contract requirements in sufficient time to allow the Government to compare the proposed materials.

1.5 GOVERNMENT'S REVIEW

1.5.1 Review Notations

Contracting Officer will review submittals and provide pertinent notation generally within 15 working days after receipt of submission. On complex or lengthy submittals requiring extensive review efforts by the Government, and on occasions when numerous submittals are made within a 15 day period, the aforementioned 15-day review period may be exceeded by the Government.

Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "APPROVED" authorize the Contractor to proceed with the work covered.

b. Submittals marked "APPROVED AS NOTED - NO RESUBMIT" authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections. The notes shall be incorporated prior to submission of the final submittal.

c. Submittals marked "APPROVED AS NOTED - RESUBMIT" require the Contractor to make the necessary corrections and revisions and to re-submit them for approval in the same routine as before.

d. Submittals marked "REJECTED - RESUBMIT" indicate noncompliance with the contract requirements and shall be re-submitted with appropriate changes.

e. Submittals marked "REVIEW NOT REQUIRED - NO ACTION TAKEN" indicate the Government is not required to approve the submitted work or operation. Such determination by the Government shall not relieve Contractor of his responsibility to perform the work in a safe and workmanlike manner and to obtain all required permits and

approvals.

f. Contractor shall make corrections required by the Contracting Officer. If Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled "Changes" shall be given to the Contracting Officer. Approval of the submittals by the Contracting Officer shall not be construed as a complete check, but will indicate only that the general method of construction and detailing is satisfactory. Contractor shall be responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at Contractor's expense.

g. If changes are necessary to approved submittals, Contractor shall make such revisions and submission of the submittals in accordance with the procedures above.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01411

GENERAL SAFETY REQUIREMENTS

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SECTION 01411

GENERAL SAFETY REQUIREMENTS
X/04

PART 1 GENERAL

1.1 SUMMARY

1.2 REFERENCES

Publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z136.1	(2000) Safe Use of Lasers

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	(2001) Occupational Safety and Health Standards
29 CFR 1926	(2001) Safety and Health Regulations for Construction
29 CFR	Labor
40 CFR	Protection of Environment
49 CFR	Transportation

GODDARD SPACE FLIGHT CENTER (GSFC)

GSFC GPG 1860.1	(2003)Ionizing Radiation Protection
GSFC GHB 1860.4	(1979) Radiation Safety Handbook - Ultraviolet and High Intensity Light Radiation
GSFC GPG 8710.2	(2004) Emergency Preparedness Program Plan for Greenbelt
GSFC 200-PG-8715.1.1	(2002) Hot Work Permits

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

ANSI/IEEE C95.1	(1999) Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA NPR 8621.1A	(2004) NASA Procedural Requirementss for Mishap Reporting, Investigating, and Recordkeeping

NASA NPG 8715.3	(2000) NASA Safety Manual
NASA STD 8719.11	(2000) Safety Standard for Fire Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2003) Code for Safety to Life from Fire in Buildings and Structures
NFPA 241	(2000) Standard for Safeguarding of Construction, Alteration, and Demolition Operations
NFPA 70	(2002) National Electrical Code

U.S. DEPARTMENT OF LABOR (USDL)

O.M.B. No. 1220-0029	Recordkeeping Guidelines for Occupational Injuries and Illnesses

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Safety Plans indicating detailed procedures which define provisions for accident prevention, health protection, and construction activity including the name, location, and responsible representative(s) for medical facility to be used for treatment of sick or injured Contractor personnel.

SD-07 Certificates

Certification of license to maintain and operate radiation producing materials and equipment used in the performance of the Work.

Accident Incident Rate Calculations

PART 2 PRODUCTS

2.1 ELECTRICAL SAFETY PRODUCTS

Locking Devices: Provide with keyed mechanisms. Combination mechanism locks are not acceptable.

Tagging Devices: Fabricated with tear and water resistant material with either a grommet that permits the tag to be installed on the locking device, or with plastic ties that cannot be easily or accidentally removed. Tags shall provide space for the name of the person installing the tag, date and time installed, and contact information (company and telephone number).

Electrical Cords: Provide extension cords without defects and suitable for the application in accordance with NFPA 70 and 29 CFR 1910. Do not use field fabricated extension cords with standard outlet boxes.

2.2 FALL PROTECTION PRODUCTS

Scaffolding and Temporary Work Platforms: Provide with approved means of access and egress, and equipped with handrails, mid rails, and toe boards, in accordance with 29 CFR 1910 and 29 CFR 1926. When handrails are not installed, provide other approved means of fall protection for all personnel working on platforms.

Safety Belts and Harnesses: Certified, inspected, and tested within five years by manufacture, with current metal certification tag attached to the belt or harness.

Lifelines: 3/4-inch diameter manila or equivalent with minimum breaking strength of 5400 pounds. Lifelines which are subjected to cutting of abrasion shall be minimum 7/8-inch diameter wire core manila rope.

Safety Belt Lanyards: Minimum 1/2-inch diameter nylon, or equivalent, with maximum length to provide for a fall of no greater than 6 feetwith nominal breaking strength of 5400 pounds.

2.3 FIRE SUPPRESSION EQUIPMENT

For ordinary combustible materials classified as Class A, provide fire extinguishers rated not less than UL-rated 2A.

For flammable liquids classified as Class B, such as paints, petroleum products, and other similar products, provide fire extinguishers rated not less than UL-rated 10B when 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are used on the job site.

For electrical components and equipment classified as Class C, provide fire extinguishers rated not less than UL-rated 10C.

Carbon tetrachloride and other toxic vaporizing liquid fire extinguishers are prohibited.

PART 3 EXECUTION

3.1 GENERAL SAFETY PROVISIONS

Contractor shall provide all necessary safety and health measures in performing the Work, and shall:

Meet with Contracting Officer to develop a mutual understanding relative to administration of safety plans.

Comply with applicable Federal, State, and local laws, regulations, ordinances, codes, and orders relating to safety and health.

Familiarize personnel and subcontractor's personnel with safety requirements.

Designate a single point-of-contact for coordination of safety concerns. Point-of-contact shall have authority to accomplish necessary corrective actions and be available at the site or by telephone during all Work. Designate an alternate point-of-contact with equal authority when designated point-of contact is unavailable.

Advise Contracting Officer of special safety restrictions established, so that Government personnel can be notified of these restrictions.

Request information on special hazards, including hazardous materials, activities and processes, that may exist in work areas as a result of Government activities.

GSFC Safety and Environmental Division (Code 250) personnel have authority to stop work on any operations that are deemed to present imminent hazard to personnel.

3.2 SAFETY PLANS

Submit a Safety Plan to Contracting Officer for approval within 10 calendar days after notice to proceed.

Safety Plan shall include, as a minimum, the following:

a. Description of the work to be performed on site (including unique hazards likely to be encountered.

b. Safety point of contact (on-site) for the Contractor.

c. Contractor statement of policy with regard to enforcement of safety and health program requirements.

d. Safety program objectives.

e. Methods to obtain safety objectives.

f. Responsibility of key personnel for the Contractor.

g. Safety meetings, surveys, inspections, and reports.

h. Type(s) of personal protective equipment that is required, under what circumstances it will be used, and how its use will be enforced.

i. Safety training required for tasks to be performed including certification and/or re-certification where applicable.

j. GSFC emergency procedures defined including instructions on notification of incidents to the EMERGENCY CONSOLE. All oil and hazardous material spills shall be immediately reported to the EMERGENCY CONSOLE via 301-286-8080.

k. Methods to comply with the requirement for immediate reporting of accidents to the Contracting Officer.

l. Statement that Contractor will not invalidate the integrity of safety systems without proper authorization.

m. Procedures for emergency actions to be taken to secure dangerous conditions, to protect personnel, and secure work areas in the event of an accident or an act of nature.

n. Procedures for securing an accident site so that the area remains secure until arrival of a GSFC Safety and Environmental Division investigator. Accident site shall remain secured until released by

Contracting Officer and GSFC Safety and Environmental Division.

o. Procedures for manageing hazardous waste. Procedures shall be in accordance with paragraph 'HAZARDOUS WASTE' of this section.

p. Procedures for responding to and removal of spills of oil and other hazardous materials shall be included to ensure the contractor's ability to meet their responsibility under federal and state regulations.

q. The Safety Plan must make reference to the following documents:
NASA NPG 8715.3
NASA NPR 8621.1A
GSFC GPG 8710.2
29 CFR 1910 or 29 CFR 1926 as applicable
Any State, County, or Local Safety Code applicable

Failure to address each of the specific requirements indicted above shall be cause for rejection of the Safety Plan.

3.3 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Institute a program for control of hazardous energy in accordance with Section 1910.147 of 29 CFR 1910 and Section 1926.417 of 29 CFR 1926. Include program documents in the Safety Plan. Make training records of employees available to the Government upon request.

No person, regardless of position or authority, shall operate controls or equipment that have an attached lockout/tagout device or tag. No tag shall be removed except as provided in this section.

Provide control of hazardous energy with both a lockout device and a tag. Where it is not possible to lockout the device, obtain approval from the Government Inspector to use the tag alone.

Pressure and vacuum systems shall be vented completely to relieve differential pressure. Vent valves shall be locked/tagged open during work on involved systems. Where contents of piping or pressure systems may present specific hazards to employees, take necessary means to provide a safe working space prior to entry. Where applicable, perform confined space entry in accordance with provisions in this section.

Appoint an individual to be responsible for the electrical safety of each work team and restrict entry to dangerous locations, as authorized by the appointed individual or jointly with the Government. Do not perform work on energized circuits of 100 volts to ground or greater without prior approval by the Government Inspector.

3.3.1 Tag Placement

Place lockout/tagout tags in accordance with the regulations printed on the back or attached to any device that may create an unsafe condition when operated.

If more than one group is scheduled to work on a circuit or equipment, the person in charge of each group shall have a separate set of lockout/tagout tags, complete and properly attached and locked.

When Government-owned and operated equipment requires tagging, the

Government will provide a "safety clearance" by reviewing the characteristics of the various systems, the safety of the operations, and the work to be done. Necessary actions will be taken, including voltage and pressure checks, grounding (except medium voltage feeder grounding), and venting to ensure that the system and equipment is safe to work on. Lockout/tagout tags will be applied to mechanical and electrical switches, valves, vents, and other mechanical devices to maintain safety.

3.3.2 Tag Removal

Lockout/tagout tags shall be removed only by persons who initiated the lockout/tagout tag and who retain possession of the keys. Otherwise, lockout/tagout tags may be removed only with the authorization of the GSFC Safety and Environmental Division.

3.4 ACCIDENT TREATMENT AND RECORDS

Post emergency first aid and ambulance information at project site.

The Government will provide emergency response for medical and other emergencies on GSFC properties in Greenbelt, Maryland. For emergency response, dial "911" from GSFC Rolm-system telephones, or dial 301.286.9111 from other telephones.

Report injury or other mishaps in accordance with NASA NPR 8621.1A.

3.4.1 Accident Incident Rate Calculations

Submit accident incident rate calculations monthly to the COTR not later than the 5th working day following the applicable month. Calculations shall be computed in accordance with O.M.B. No. 1220-0029 and as follows:

$$\text{Incident Rate} = \frac{\text{Total Number of Injury Cases} \times 200{,}000}{\text{Total Number of Manhours Worked}}$$

$$\text{Incident Rate (Lost Time)} = \frac{\text{Number of Lost Workday Injuries} \times 200{,}000}{\text{Total Number of Manhours Worked}}$$

$$\text{Incident Rate (Restricted Duty)} = \frac{\text{Number of Restricted Work Injuries} \times 200{,}000}{\text{Total Number of Manhours Worked}}$$

Incident rates for lost workdays and restricted workdays will indicate when lost and restricted time is the result of carryover from previously recorded injury cases.

Total Number of Manhours Worked and Total Injuries shall be from NTP thru calendar month to date.

3.5 FIRE PREVENTION AND PROTECTION

Report all fires to the Emergency Console at 911 or 301.286.9111.

Complete all construction, alteration, and demolition operations in accordance with NFPA 241 and NASA STD 8719.11.

3.5.1 Open Flame Heating Devices

Do not operate open-flame heating devices unless written approval is obtained from the Contracting Officer. Approval for the use of open-flame heating devices will not relieve Contractor from responsibility for damages incurred from a fire caused by an open-flame heating device.

Open fires and burning of trash, debris, or excess materials are strictly prohibited.

3.5.2 Fire Extinguishers

Provide fully charged fire extinguishers which are suitable for the existing hazards in accordance with Section 1926.150 of 29 CFR 1926 throughout all parts of the worksite under control of the Contractor, including areas with operational sprinkler systems. Provide one fire extinguisher for every 3,000 square feet with maximum unobstructed travel distance of 100 feet from any point in the protected area to fire extinguisher. Inspect fire extinguishers monthly and maintain in operating condition.

3.5.3 Hot Work

For all hot work operations, obtain a "Hot Work" Permit(GSFC 23-4), and conduct in accordance with GSFC 200-PG-8715.1.1. Construction activities are designated as hot work operations when flame or heat generated from welding, cutting, sweating, torching, roof kettles, etc. is capable of igniting combustible materials.

Discontinue burning, welding, or cutting operations one hour prior to the end of the normal work day. Provide a workman at the project site for one hour after discontinuing these operations to make a complete inspection of the area for possible sources of latent combustion. Equip person with two full20-pound dry chemical fire extinguishers. Report unsafe conditions to the GSFC Safety and Environmental Division at 301.286.6295. In an emergency, report fires by calling "112" from center Rolm-system phones, or 301.286.9111 from other local phones.

3.5.4 Materials Storage

Store combustible and flammable materials in accordance with National Fire Protection Codes and applicable Federal, State, and local laws and regulations. Do not allow combustible and flammable debris to accumulate at the work site without approval of the Contracting Officer.

3.6 ELECTRICAL TOOLS AND EQUIPMENT SAFETY

Implement the Assured Equipment Grounding Program or the Ground Fault Circuit Interrupters Program for the Project site in accordance with Section 1926.404 of 29 CFR 1926. Do not implement a combination of these two programs. Include a written description of the electrical safety program in the Safety Plan with specific procedures to be adopted by the Contractor. Designate in writing one or more competent persons as defined in Section 1926.32(i) of 29 CFR 1926 to implement the program. Make a copy of the program available at the Project site for inspection and copying.

Inspect electrical tools and equipment for defects and damage prior to use. Repair or replace defective tools and equipment prior to use.

3.7 WORK IN CONFINED SPACES

For work involving confined spaces such as, but not limited to, tanks, vaults, manholes, water tower, excavations, tunnel systems, air handlers, etc comply with the requirements of 29 CFR 1910, Section 1910.146.

A person is not permitted to enter a confined space until an assessment of that space is made and specific authorization by entry permit (GSFC 23-52 where required) or specific operating procedure is obtained from a GSFC Confined Space Monitor (Government Inspector).

3.8 RADIATION SAFETY REQUIREMENTS

Comply with GSFC GPG 1860.1, ANSI/IEEE C95.1, ANSI Z136.1, and GSFC GHB 1860.4, and applicable regulations of the United States Nuclear Regulatory Commission, in the use of ionizing and non-ionizing radiation. The GSFC Radiation Protection Officer (RPO) (Code 250) will be the Contracting Officer's Technical Representative relating to radiation safety.

In addition to other reporting requirements contained in public law, immediately report any loss of radioactive material to the Contracting Officer and to the GFSC Radiation Protection Officer at 301.286.4693 (Report emergencies to 112 from center Rolm phones, or 301.286.9111 from outside lines).

3.8.1 License Certification

Submit certification of license to maintain and operate radiation producing materials and equipment used in the performance of the Work.

3.8.2 Radiographic Procedure

Do not perform work involving actual exposure of radiographic film or unshielding the source during normal daily working hours and not prior to 5 p.m. on weekdays.

3.9 FACILITY OCCUPANCY CLOSURE

Do not close or obstruct streets, walks, building egress paths, and other facilities occupied and used by the Government without prior written permission from the GSFC Safety and Environmental Division. Authorization will be granted only after adequate plans and provisions are proposed to meet the egress and emergency response needs of the facility's occupants.

In buildings that are occupied or partially occupied by personnel other than Contractor's personnel, maintain all required exits, exit access, and exit discharge, free of obstructions and impediments to allow for instant use in case of fire or other emergency. Comply with NFPA 101.

In buildings occupied only by Contractor's personnel, maintain adequate escape facilities for use by construction workers at all times.

3.10 PROTECTION OF WORK

Protect structures, utilities, sidewalks, pavements, and other facilities located adjacent to excavations. Submit a Protection Plan indicating procedures to prevent damage to existing facilities and infrastructures. Immediately repair or replace damaged facilities.

3.11 HIGH NOISE LEVEL PROTECTION

Do not schedule operations that involve the use of equipment with output of high noise level output (jackhammers, air compressors, and explosive device activated tools) in occupied areas during normal duty hours. Prior to operating high noise level equipment in occupied areas, obtain approval in writing from the Government Inspector.

3.12 HAZARDOUS WASTE

Generate, handle, and store hazardous wastes in accordance with 29 CFR, 40 CFR,49 CFR, and all otherapplicable Federal, State, and local regulations.

Upon request by the Contracting Officer, provide documentation that personnel are duly trained in generating, handling and storing hazardous wastes.

The Contractor is responsible for properly managing and disposing of Contractor-owned generated wastes.

Notify the Government Inspector assigned to the Project if Government-owned hazardous waste is discovered. The Government Inspector will contact the GSFC Hazardous Waste Specialist. Government-owned hazardous wastes will be removed by the Government.

For assistance in determining if Government-owned waste is hazardous, contact the GSFC Hazardous Waste Specialist at 301.286.9233, or the Environmental Team at 301.286.6295.

-- End of Section --

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DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01500

TEMPORARY UTILITIES AND CONTROLS

03/04

-- End of Section Table of Contents --

SECTION 01500

TEMPORARY UTILITIES AND CONTROLS
03/04

PART 1 GENERAL

1.1 SUMMARY

The requirements of this section apply to, and are a component of, each section of the specifications.

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-02 Shop Drawings

Temporary Utilities and Controls Plan indicating the proposed use and location of construction signs, temporary utility connections required, traffic plan (if encumbrance to traffic will occur), and dust control measures if needed.

PART 2 PRODUCTS

2.1 CONSTRUCTION SIGN

Signs required by law and such signs necessary to maintain traffic flow, promote safety (eg. "CAUTION", "DANGER", "HARDHAT AREA", and the like) shall be placed as required. The Contractor shall not place any other signs on the GODDARD SPACE FLIGHT CENTER without the writtten approval of the Contracting Officer.

PART 3 EXECUTION

3.1 TEMPORARY UTILITIES

3.1.1 Electricity

The Government will make available to the Contractor reasonable amounts of electrical power from the existing receptacles in the building.
Worksite lighting, as required beyond the fixed lignting in the building, shall be provided by the Contractor.

3.1.2 Water

The Government will make available to the Contractor reasonable amounts of water from the existing services within the building..

3.2 TRAFFIC PROVISIONS

3.2.1 Access to GSFC

Contractor's access to the worksite shall be restricted to those gates as permitted by GSFC Security. The Contractor shall be responsible escorting equipment and material delivery vehicles to and from the worksite within GSFC property, as required by GSFC Security procedures.

3.2.2 Maintenance of Traffic

Contractor shall conduct his operations in a manner that will not close any automotive or pedestrian thoroughfare, and shall not interfere in any way with automotive or pedestrian traffic without written permission of the Contracting Officer. Within the plant, contractor shall conduct operations in a manner that will not impede access to operating equipment, without prior approval by the Plant Operators.

3.3 PROTECTION OF EXISTING CONDITIONS

Existing conditions shall not be disturbed beyond the extents indicated. Protect existing conditions not to be disturbed from damage. Repair to new condition any existing conditions that are disturbed beyond extents indicated.

Penetrations of existing building exteriors shall be provided with temporary watertight protection whenever left open before completion of work, and shall be closed and sealed permanently promptly upon completion of necessary work.

3.3.1 Utilities

Existing utilities and new operational utilities shall be protected from damage. Utilities damaged by Contractor shall be repaired at the Contractor's expense. Damaged utilities, not defined on drawings or identified to the Contractor, shall be reported immediately to the Contracting Officer.

3.3.2 Safety

Contractor shall protect the integrity of any installed safety systems or personnel safety devices.

If it is necessary to temporarily remove or disable personnel safety devices in order to accomplish contract requirements, Contractor shall provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and shall obtain prior approval from the Contracting Officer.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01770

CONTRACT CLOSEOUT

X/04

-- End of Section Table of Contents --

SECTION 01770

CONTRACT CLOSEOUT
X/04

PART 1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications. This section establishes a series of requirements that ensure an efficient and reliable final acceptance of the work.

1.2 REFERENCES (Not Applicable)

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-10 Operation and Maintenance Data

Submit seven copies and two electronic copies of the Operation and maintenance manuals.

Submit two copies and one electronic copy of the manuals not later than 60 days prior to the proposed date for the operational readiness review.

Upon approval by the Government, incorportate any comments provided, and submit the remaining five copies and one electronic copy at the ORR.

SD-11 Closeout Submittals

Submit schedule for task order closeout not less than 45 days prior to the anticipated date for the first equipment start-up and field test. Schedule shall include a list of equipment items and systems, field testing sequence and procedures, pre-final inspection procedures, Operation and Maintenance Manual submission, training agenda and materials, and operational readiness review procedures. When required by the contract, indicate designated portions of the work which will require a partial contract closeout. Include necessary forms, descriptions, equipment required, and Government and Contractor personnel to be involved.

Submit one complete hardcopy red-line set and one complete electronic red-line set of Final As-Built Drawings.

Final payment will be withheld until above submittals are received and approved by the Contracting Officer.

1.4 CLOSEOUT PROCEDURES

Contractor shall complete the following, in the sequence indicated, prior

to requesting final inspection for final acceptance of the project:

Submit proposed schedule for contract closeout.

Conduct field testing of equipment and systems, and submit test reports.

Perform pre-final inspection of equipment and systems.

Submit Operation and maintenance manuals.

Conduct operational readiness review (ORR) of equipment and systems.

Submit project record documents.

Complete final cleaning requirements.

When the above items have been completed, request inspection for final acceptance.

1.5 FIELD TESTING

Conduct field testing and submit test reports as required in the technical sections to demonstrate that installed products, equipment and systems perform as specified. Perform field testing in the presence of Government inspectors.

1.6 PRE-FINAL INSPECTION

When field testing has been completed and accepted by the Government, the Contractor shall perform a pre-final inspection of all equipment and systems to ensure that equipment and related systems and controls operate properly in accordance with their stated sequence of operation. The pre-final inspection shall be conducted by the Contractor and shall include subcontractors and other qualified parties as necessary who can properly operate the equipment and systems. Conduct pre-final inspection in the presence of Government personnel, including the Construction Manager and Inspectors.

1.7 OPERATION AND MAINTENANCE MANUALS

1.7.1 Manual Contents

Include copies of Final "approved" or "approved as noted" (AS-BUILT SHOP DRAWINGS) submittals (SDs), including test reports, excluding samples, as required in the technical sections. Include spare parts data indicating part number, manufacturer, and stock level required for maintenance and repair. Include warranty information as required by this specification section. Include operation procedures which includes items such as startup, shutdown, emergency procedures, etc. Include maintenance procedures which includes items such as periodic requirements, step by step instructions if needed to perform preventative maintenance. Include only data which is applicable to the equipment installed; cross out non-relevent information as extraneous information will not be accepted. Data contained in manual shall accurately reflect as-built conditions.

1.8 WARRANTIES

Warranty information shall be included in the Operation and Maintenance Manual.

1.8.1 Warranty of Construction

All work is provided with the standard one-year Warranty of Construction. Provide Contractor's warranty contact name, address and telephone number, to whom the Government should make warranty calls.

1.9 OPERATIONAL READINESS REVIEW (ORR)

Arrange for each installer of the following equipment and systems to meet with Government personnel and provide an operational readiness review (ORR), for the equipment/systems indicated below or as required by individual technical sections:

Boiler Drum Heaters
Related piping, valves and steam traps

Provide instruction by manufacturer's representative if installers are not experienced in the proper operation and maintenance procedures.

Conduct ORR after each installation of the systems and equipment involved are complete, all testing of systems and equipment involved are complete, and test results are approved by the Contracting Officer.

Instruction shall include a review of operation and maintenance procedures, record documents, spare parts list, tools, lubricants, fuels, identification systems, control sequences, potential hazards, cleaning, and warranties. As part of instruction for operating equipment, demonstrate startup, shutdown, emergency operations, noise and vibration adjustment, safety procedures, economy and efficiency adjustments, and effective energy utilization. Clearly demonstrate that the equipment operates as required.

Perform ORR in the presence of Government personnel, including Project Manager, Construction Manager, discipline engineer, Inspectors, operation and maintenance personnel, Facility Operation Manager, Building Manager, and building tenant (customer). All material, equipment, instrumentation, and personnel required for the ORR shall be provided by the Contractor.

1.10 PROJECT RECORD DOCUMENTS

1.10.1 Final As-Built Drawings

Submit one complete set of final "red-lined" As-Built Drawings containing all corrections, additions, deletions and other changes made during the progression of the work. Drawing markups shall be in accordance with requirements specified for As-Built Drawings in Section 01200, "PROJECT MANAGEMENT."

1.11 FINAL CLEANING

Prior to the inspection for Final Acceptance, execute final cleaning.

Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains and films. Wet-mop clean concrete floors.

Clean equipment and fixtures to a sanitary condition with appropriate cleaning materials. Clean surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances.

1.12 FINAL ACCEPTANCE

When the requirements of this Section have been completed, Contractor shall request final inspection. The Government will inspect the work, and upon completion of the inspection, will issue a written final acceptance to the Contractor. If the work is incomplete, the Government will advise the Contractor of work that is incomplete and required for final acceptance. If necessary, inspection will be repeated.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 15 - MECHANICAL

SECTION 15003

GENERAL MECHANICAL PROVISIONS

03/01

-- End of Section Table of Contents --

SECTION 15003

GENERAL MECHANICAL PROVISIONS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A13.1	(1996) Scheme for the Identification of Piping Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(1999; Rev E1) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM B 766	(1986; R 1998) Standard Specification for Electrodeposited Coatings of Cadmium

UNDERWRITERS LABORATORIES (UL)

UL-02	(2000) Building Materials Directory

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's Catalog Data shall be submitted for the following items:

Mechanical Systems Identification Materials

SD-11 Closeout Submittals

As-Built Drawings shall provide current factual information including deviations from, and amendments to the drawings and concealed or visible changes in the work.

1.3 COORDINATION

Contractor shall coordinate the work of the different trades so that interference between piping, equipment, structural, and electrical work will be avoided. All necessary offsets in piping and all fittings, etc., required to install the work properly shall be furnished complete in place at no additional cost to the Government.

1.4 MECHANICAL SYSTEMS IDENTIFICATION

1.4.1 Service Labeling

All piping and ductwork, including that concealed in accessible spaces; exposed, bare and painted; and insulated, shall be labeled to designate service. Each label shall include an arrow or arrows to indicate flow direction.

Piping shall be labeled and arrowed in accordance with the following:

Each point of entry and exit of pipe passing through walls

In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.

In long straight runs, labels shall be located at distances within eyesight of each other but in no case shall the distance between labels exceed 75 feet. All labels shall be visible and legible from the primary service and operating area.

Bare or Insulated Outside Dimension	Minimum Height of Lettering
1/2 thru 1-1/4 inch	1/2 inch
over 1-1/4, thru 2 inch	3/4 inch
over 2 inch, thru 6 inch	1-1/4 inch

Labels shall be made of self-sticking, plastic film designed for permanent installation. Labels shall be color-coded in accordance with ANSI A13.1, and legends shall be in accordance with "TABLE OF PIPING AND DUCTWORK LABELS AND COLOR CODING" at the end of this section.

1.4.2 Valve Tags

Provide tags and system diagrams for new or modified Power Plant mechanical systems. Identification tags made of brass or aluminum indicating function of a valve, control or similar component shall be installed on such system devices. Tags shall be 2 inches in diameter and marking shall be stamped. System or service abbreviation, and numbering, shall be as indicated on drawings.

Tags shall be wired to valve or equipment items with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire.

1.4.3 Color Coding

Piping in the power plants, Buildings 24 and 31, shall be painted with color codes in accordance with "TABLE OF PIPING AND DUCTWORK LABELS AND COLOR CODING" at the end of this section.

1.5 APPROVAL REQUIREMENTS

Except as otherwise specified, approval of materials and equipment will be based on manufacturer's published data.

Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL-02 will be acceptable as sufficient evidence that the items conform

to Underwriters Laboratories requirements. In lieu of such label or listing, the Contractor may submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Methods of testing used by the specified agencies shall be outlined.

Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the American Society for Testing and Materials (ASTM), the American Society of Mechanical Engineers (ASME), or other standards, a manufacturer's certificate of compliance of each item will be acceptable as proof of compliance.

Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.6 PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given rust-inhibiting treatment and standard finish by the manufacturer. Aluminum shall not be used in contact with earth, and where connected to dissimilar metal, shall be protected by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123 for exterior locations and cadmium-plated in conformance with ASTM B 766 for interior locations.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 INSTALLATION

Materials and equipment shall be installed in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouching shall be accomplished only if approved; otherwise, equipment shall be returned to the factory for refinishing.

3.2 CUTTING AND PATCHING

Contractor shall install his work in such a manner and at such time as will require a minimum of cutting and patching. Except as detailed on the drawings, no structural members shall be penetrated without the specific approval of the Contracting Officer.

Holes in exposed locations, in or through existing floors, shall be drilled and smoothed by sanding. Use of a jackhammer will be permitted only where specifically approved. Protective measures shall be provided to control accumulation and migration of dust and dirt during all cutting and patching operations. Dust, dirt, and debris shall be removed from the areas of work daily. Protective measures shall prevent migration of dust or dirt from the construction area into adjacent occupied areas, including as necessary, temporary partitions or plastic sheeting enclosing the construction area, shutting or covering of return air intakes in the construction area, or exhaust from the construction area to the outside of the building.

Holes through masonry walls to accommodate sleeves shall be made with an

iron pipe masonry core saw.

3.3 PROTECTION OF INSULATION MATERIALS

Porous materials such as pipe insulation, duct insulation and duct liner, shall be protected from moisture while in storage at the site. Any such materials that become wet shall be discarded. During and after installation, such materials shall be protected from moisture, and if they become wet shall be removed and discarded, and shall be replaced with new materials. Drying, cleaning, or disinfecting of such materials once they have been wet is not acceptable.

3.4 CLEANING

Exposed surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction shall be thoroughly cleaned before such surfaces are prepared for final finish painting or are enclosed within the building structure.

Before final acceptance, mechanical equipment, including piping, ducting, and fixtures, shall be clean and free from dirt, grease, and finger marks.

3.5 LABELS AND COLOR CODING OF PIPING

Piping shall be labeled in accordance with the paragraph entitled "Service Labeling". Label legends and color coding shall be as indicated in the following table:

TABLE OF PIPING AND DUCTWORK LABELS AND COLOR CODING

SERVICE	**LABEL LEGEND**	**LABEL COLOR (Legend/Background)**	**PAINT COLOR (Power Plants Only)**
Steam (High Pressure)	HIGH PRESSURE STEAM	black/yellow	orange (to match existing)
Steam Condensate Return (High Pr.)	HIGH PRESSURE CONDENSATE	black/yellow	orange (to match existing)

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

03/04

-- End of Section Table of Contents --

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS
03/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 105/A 105M	(1998) Standard Specification for Forgings, Carbon Steel, for Piping Components
ASTM A 106	(1999; Rev E1) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 182/A 182M	(1999) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 216/A 216M	(1993 R 1998) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service
ASTM A 234/A 234M	(1999) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A 325	(2000) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(1996) Valves - Flanged, Threaded, and Welding End
ASME B16.39	(1998) Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300
ASME B16.5	(1996) Pipe Flanges and Flanged Fittings

	NPS 1/2 Through NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.2	(1987; R 1999) Square and Hex Nuts
ASME B31.1	(2001) Power Piping
ASME B31.9	(1996) Building Services Piping
ASME B36.10M	(1996) Welded and Seamless Wrought Steel Pipe
ASME BPV I	(2001) Boiler and Pressure Vessel Code; Section I, Power Boilers

AMERICAN WELDING SOCIETY (AWS)

AWS A5.13	(1989) Specification for Solid Surfacing Welding Rods and Electrodes
AWS-02	(1990) Welding Handbook; Eighth Ed; Vol Two - Welding Process

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

Welding shall comply with the applicable requirements of Section 15055, "Welding and Pressure Vessels/Systems". All installation or modification of piping or components defined in Section 15055, "Welding and Pressure Vessels/Systems" as Pressure Vessels and Pressurized Systems (PV/S) shall comply with the applicable requirements of that Section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's Data shall be submitted for the items listed below. Data shall include preprinted catalog data, plus any supplemental data required to provide sufficient detail to show full compliance with the specifications. Data shall include statements of compliance with indicated standards, equipment outline and

dimension drawings, and performance data tables or curves as applicable.

Pipe and Fittings
Piping Specialties
Valves
Miscellaneous Materials
Supporting Elements

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals, shall be submitted for the following items, in accordance with Section 01770, "Contract Closeout". Manuals shall include approved submittal data, manufacturer's operation, maintenance and repair instructions, spare parts lists.

Valves (all types)
Piping Specialties

SD-11 Closeout Submittals

PV/S Certification Records shall be submitted for PV/S piping and components, for approval and Certification prior to pressurization and operation. Pressure vessels and pressurized systems (PV/S), and the required contents of the PV/S Certification Records, shall be as defined in Section 15055, "Welding and Pressure Vessels/Systems"

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Type BCS-150 (150-psi Service)

Pipe or tube (1/8 inch through 10 inches): Schedule 80, seamless black carbon steel, conforming to ASTM A 106, Grade B and ASME B36.10M

Fittings (1/8 inch through 2 inches): 2,000-or 3,000-psi water, oil, or gas (wog) forged carbon steel, socket weld or flanged end, conforming to ASTM A 105/A 105M and ASME B16.11

Fittings (2-1/2 through 10 inches): Wall thickness to match pipe, long radius, butt weld, black carbon steel, conforming to ASTM A 234/A 234M, Grade WPB, and ASME B16.9

Unions (1/8 inch through 2 inches): 250-psi wsp, malleable iron, screwed end, ground joint, with brass or bronze seat insert, conforming to ASME B16.39

Unions (1/8 inch through 2 inches): 2,000 or 3,000-psi wog, forged carbon steel; socket weld through 2-inch, screwed end through 1-inch, conforming to ASTM A 105/A 105M and ASME B16.11, with ground joint and stainless-steel seat insert

Flanges (2-1/2 through 10 inches): 150-pound, forged carbon steel, welding neck, with raised face or flat face and concentric finish, conforming to ASTM A 105/A 105M and ASME B16.5

Flange gaskets: Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, of self centering flat ring type. Metallic spiral wound nonasbestos gaskets shall be used for steam, condensate and drain lines.

Bolting: Bolting and flange bolting shall be hexhead and shall conform to ASTM A 325. Heavy hex-nuts shall conform to ASME B18.2.2. Square-head bolts and nuts are not acceptable.

2.2 PIPING SPECIALTIES

Unless otherwise noted specialties shall be as indicated below, with soldered, threaded or flanged ends to match the fitting type specified for the piping in which they are installed. All packing and gasket materials shall be made of non-asbestos containing materials.

2.2.1 Strainers, High Temperature/Pressure Service (Type HTP)

Strainers shall be Y-type with removable strainer element.

Body end connections shall be flanged for all strainers larger than 2 inches, unless butt weld ends are specified. Screwed or Socket weld shall be used for sizes 2 inches and under to suit specified piping system end connection.

Strainers located in tunnels, trenches, manholes, and valve pits shall have welded end connections.

Strainers shall comply with ASTM F 1200 and have a working pressure rating of 150 psig working steam pressure (wsp). Body shall have integral cast or forged arrows to indicate direction of flow. Strainer bodies shall be provided with blowdown valves that have discharge end plugged with a solid metal plug. Closure assembly shall be made with tetrafluoroethylene tape. Bodies fitted with bolted-on screen retainers shall have offset blowdown holes. Strainers in sizes 2 inches and larger shall be fitted with manufacturers standard ball-type blowdown valve

Body materials shall be cast steel conforming to ASTM A 216/A 216M, Grade WCB or forged carbon steel conforming to ASTM A 105/A 105M or manufacturer's standard metallurgical equivalents for service pressures of 150-psi wsp and greater.

Minimum free-hole area of strainer element shall be equal to not less than 3.4 times the internal area of connecting piping. Strainer screens shall have perforations not to exceed 0.045-inch or equivalent wire mesh. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 or 316 corrosion-resistant steel and shall be fitted with backup screens where necessary to prevent collapse.

2.3 VALVES

Unless otherwise noted, valves shall be as specified below, with welded or flanged ends to match the fitting type specified for the piping in which they are installed. Packing and gaskets shall be made of non-asbestos containing materials.

2.3.1 Gate Valves (GAV-150)

Valves shall be rated 150-psi (wsp) and shall conform to ASME B16.34.

Body end connections shall be flanged for all valves larger than 2 inches unless butt weld ends are specified. Screwed or socket weld shall be used for sizes 2 inches and under to suit specified piping system end connection and maintenance requirements. Flange faces shall have concentric serrated finish.

Body to bonnet connection shall be union or gasketed-bolted type for valves 2 inches and under and gasketed-bolted type for valves larger than 2 inches. Bonnet shall be OS&Y type, rising stem.

Body and bonnet assembly shall be cast steel or forged carbon steel. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

Trim for valves larger than 2 inches shall include hard surfaced solid or one-piece flexible-wedge disk and hard-surfaced seats. Trim for valves 2 inches and under shall include hard-surfaced, hardened-solid or one-piece flexible wedge disk and hard-surfaced hardened seats. Hardened components shall have Brinell hardness of not less than 500. Stem shall be rising and backseating type.

Trim materials and hard-surfaced substrates shall conform to ASTM A 182/A 182M, Grade F6 or shall be manufacturer's standard metallurgical equivalents for the specified service.

Hard-surfacing alloy shall conform to AWS A5.13, Class RNiCr-B or Class RCoCr-B.

Packing shall be wire reinforced, fiber braid impregnated with 30 percent tetrafluoroethylene or a corrosion-inhibiting lubricant specifically suitable for service with stem material provided.

Valve wheels shall be cast iron, malleable iron or wrought steel.

2.3.2 Globe Valves (GLV-150) and Angle Valves (ANV-150)

Valves shall be rated 150-psi working steam pressure (wsp) and shall conform to ASME B16.34.

Body end connections shall be flanged for all valves larger than 2 inches, unless butt weld ends are indicated. Screwed or socket weld shall be used for sizes 2 inches and under to suit specified piping system end connection and maintenance requirements. Flange faces shall have concentric serrated finish.

Body to bonnet connection shall be union or gasketed-bolted type for valves 2 inches and under; gasketed-bolted type for valves larger than 2 inches; and for valves 3/8 inchand under, assembly shall be screwed type. Bonnet shall be OS&Y type, except that valves 3/8 inch and under shall be inside screw type.

Body and bonnet assembly shall be cast steel or forged carbon steel. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

Trim for valves larger than 2 inches and for all sizes of valves in bypass service shall include hard-surfaced, solid plug disk and hard-surfaced seats. Plug material in valves 2 inches and under shall be in accordance

with AISI 400 series corrosion-resistant steel hardened to not less than 500 Brinell. Stem shall be rising and backseating type.

Trim materials and hard surface substrates shall conform to ASTM A 182/A 182M, Grade F6 shall be manufacturer's standard metallurgical equivalents for the specified service.

Hard-surfacing alloy shall conform to AWS A5.13, Class RNiCr-B or Class RCoCr-B.

Packing shall be wire reinforced, fiber braid impregnated with 30 percent tetrafluoroethylene or a corrosion-inhibiting lubricant specifically suitable for service with stem material provided.

Valve wheels shall be cast iron, malleable iron or wrought steel.

2.3.3 Check Valves (CV-150)

Valves shall be rated 300-psi wsp and shall conform to applicable portions of ASME B16.34.
Valves shall be horizontal swing-check type.

Body end connections shall be flanged for all valves larger than 2 inches unless butt weld ends are specified. Screwed or socket weld shall be used for sizes 2 inches and under to suit specified piping system end connection and maintenance requirements. Flange faces shall have concentric serrated finish.

Body to cover connection shall be union or gasketed-bolted type.

Body and bonnet assembly shall be cast steel or forged carbon steel. Cast steel shall conform to ASTM A 216/A 216M, Grade WCB. Forged carbon steel shall conform to ASTM A 105/A 105M.

Trim materials, including hinge pin, shall be manufacturer's standard corrosion-resistant alloys for the specified service.

2.3.4 Safety Valves

Safety Valves shall be sized, constructed and fully comply with requirements as set forth in ASME BPV I. Valves shall have a manual lifting device for testing.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Bolting

Bolting: Bolting and flange bolting shall be hexhead and shall conform to ASTM A 325. Heavy hex-nuts shall conform to ASME B18.2.2. Square-head bolts and nuts are not acceptable.

2.4.2 Flange Gaskets

Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, of self centering flat ring type. Metallic spiral wound nonasbestos gaskets shall be used for steam, condensate and drain lines.

2.4.3 Mechanical Penetration Seals

Mechanical penetration seals shall be mechanically expandable inserts with EPDM sealing elements, non-metallic pressure plates, and stainless steel bolts and nuts. Unit shall be rated for temperatures from -40 degrees F to 250 degrees F.

2.5 SUPPORTING ELEMENTS

All necessary piping systems and equipment supporting elements shall be provided, including but not limited to: building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides; and spring-cushion, variable, or constant supports. All supporting elements shall be suitable for stresses imposed by systems pressures and temperatures and natural and other external forces normal to this facility without damage to supporting element system or to work being supported.

Supporting elements shall conform to requirements of ASME B31.1 or ASME B31.9, MSS SP-58, and MSS SP-69 except as noted.

Attachments welded to pipe shall be made of materials identical to that of pipe or materials accepted as permissible raw materials by referenced code or standard specification.

Type designations specified herein are based on MSS SP-58 and MSS SP-69. Support elements, except for supplementary steel, shall be cataloged, load rated, commercially manufactured products.

Piping shall not be supported from ductwork hangers or supports, or from hangers supporting fire protection (sprinkler and standpipe systems) piping.

2.5.1 Building Structure Attachments

2.5.1.1 Beam Clamps

Beam clamps shall be center-loading Type 21, 28, 29, or 30.

When it is not possible to use center-loading beam clamps, eccentric-loading beam clamps, Type 20, 25, or 27 may be used for piping sizes 2 inches and less and for piping sizes 2 through 10 inches provided two counterbalancing clamps are used per point of pipe support. Where more than one rod is used per point of pipe support, rod diameter shall be determined in accordance with referenced standards.

2.5.1.2 C-Clamps

Type 23 C-clamps or type 19 C-type beam clamps may be used to support piping sizes 2 inches and smaller. C-clamps and C-type clamps shall be FM approved and UL listed with hardened cup-tip setscrew, locknut, and retaining strap not less than 1/8 inch by 1 inch. Clamps secured to one side of beam with only setscrews are not acceptable. Beam flange thickness to which clamps are attached shall not exceed 0.60 inch.

2.5.2 Horizontal Pipe Attachments

2.5.2.1 Single Pipes

Piping in sizes to and including 2-inch ips shall be supported by Type 6

solid malleable iron pipe rings, except that split-band-type rings may be used in sizes up to 1-inch ips.

2.5.3 Hanger Rods and Fixtures

Only circular cross section rod hangers may be used to connect building structure attachments to pipe support devices. Pipe, straps, or bars of equivalent strength shall be used for hangers only where approved.

Turnbuckles, swing eyes, and clevises shall be provided as required by support system to accommodate temperature change, pipe accessibility, and adjustment for load and pitch. Rod couplings are not acceptable.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

Piping systems shall be fabricated and installed in accordance with ASME B31.1 or ASME BPV I, as applicable to the service, MSS SP-69, and AWS-02, and other requirements or standards specified in the specification section for the type of system.

Piping systems shall be securely supported with due allowance for thrust forces, thermal expansion and contraction, and shall not be subjected to mechanical, chemical, vibrational or other damage as specified in ASME B31.9 or ASME B31.1.

Field welded joints shall conform to the requirements Section 15055, "Welding and Pressure Vessels/Systems".

3.2 VALVES

Valves shall be provided in piping mains and all branches and at equipment where indicated and as specified. Valves shall be installed with the stems upright unless otherwise indicated or approved.

3.3 SUPPORTING ELEMENTS INSTALLATION

Supporting elements shall be provided in accordance with the referenced codes and standards.

Piping shall be supported from building structure. No piping shall be supported from roof deck or from other pipe.

Piping shall run parallel with the lines of the building. Piping and components shall be spaced and installed so that a threaded pipe fitting may be removed between adjacent pipes and so that there shall be no less than 1/2 inch of clear space between the finished surface and other work and between the finished surface of parallel adjacent piping. Hangers on different adjacent service lines running parallel with each other shall be arranged to be in line with each other and parallel to the lines of the building.

Piping support elements shall be installed at intervals specified hereinafter, at locations not more than 3 feet from the ends of each runout, and not over 1 foot from each change in direction of piping.

Load rating for all pipe-hanger supports shall be based on insulated weight of lines filled with water and forces imposed. Deflection per span shall

not exceed slope gradient of pipe. Supports shall be in accordance with the following minimum rod size and maximum allowable hanger spacing for specified pipe, unless otherwise indicated in the specification section for the individual system. For concentrated loads such as valves, the allowable span shall be reduced proportionately:

PIPE SIZE INCHES	ROD SIZE INCHES	STEEL PIPE FEET	COPPER PIPE FEET
1 and smaller	3/8	8	6
1-1/4 to 1-1/2	3/8	10	8
2	3/8	12	10
2-1/2 to 3-1/2	1/2	12	12
4 to 5	5/8	16	14

3.4 PIPE EXPANSION

The expansion of supply and return pipes shall be provided for by changes in the direction of the run of pipe, by expansion loops unless expansion joints are indicated on drawings. If indicated, drawings shall include type of expansion joint, specification and ratings.

3.5 CLEANING

Piping shall be flushed with potable water until visible grease, dirt and other contaminants are removed (visual inspection).

3.6 PRESSURE VESSELS/SYSTEMS (PV/S) CERTIFICATION

All installation or modification of PV/S piping and components shall comply with the requirements of Section 15055, "Welding and Pressure Vessels/Systems", and PV/S Certification Records shall be prepared as indicated in that section. This data shall be submitted and approved, and the system or components Certified by the Government, prior to pressurization and operation.

3.7 TESTING AND OPERATIONAL READINESS REVIEW (ORR)

Testing and Operational Readiness Reviews for piping and valves are specified in other Division 15 sections, for the particular systems in which they are installed.

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15055

WELDING AND PRESSURE VESSELS/SYSTEMS

03/01

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SECTION 15055

WELDING AND PRESSURE VESSELS/SYSTEMS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.1	(2001) Power Piping
ASME B31.9	(1996) Building Services Piping
ASME BPV V	(2001) Boiler and Pressure Vessel Code; Section V, Nondestructive Examination
ASME BPV VIII Div 1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels, Division 1, Basic Coverage
ASME BPV IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications
ASME BPV VIII Div 2	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 2 - Alternatives Rules for Basic Coverage

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBPVI)

NBBPVI-23	(1998) National Board Inspection Code

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's Catalog Data shall show type, voltage and/or amperage for the following items, for any field installation, or modification, of PV/S:

Welding Equipment
Welding Rods and Accessories

SD-04 Samples

The following samples shall be submitted, for any field installation, or modification, of PV/S:

Welder's Pre-Qualification Samples

SD-07 Certificates

Within fifteen days after receipt of Notice to Proceed, the Contractor shall submit for approval to the Contracting Officer the following items, for any field installation, or modification, of PV/S:

Certified Welding Procedure Specifications (WPS)
Certified Brazing Procedure Specifications (BPS)
Certified Procedure Qualification Records (PQR)

SD-07 Certificates

Fifteen calendar days prior to any employee welding on project material, the Contractor shall submit for approval to the Contracting Officer the following items, for any field installation, or modification, of PV/S:

Certified Welder Performance Qualifications (WPQ)
Certified Brazer Performance Qualifications (BPQ)

SD-06 Test Reports

Test Reports shall be submitted for Radiographs

SD-11 Closeout Submittals

PV/S Certification Records shall be submitted for all pressure vessels and pressurized systems (PV/S). Records shall be identified with the description of the PV/S including all applicable GOMARS numbers for included equipment. Records shall include, as applicable to the particular PV/S installed in the project, all applicable items specified in this section in the paragraph entitled, "Documentation for Pressure Vessels and Systems.

1.3 SCOPE OF PRESSURE VESSELS AND PRESSURIZED SYSTEMS (PV/S)

Pressure Vessels and Pressurized Systems (PV/S) in general include the following components: Pressure Vessels, Tanks, Vacuum Vessels, Flexible Hoses, Expansion Joints, Relief Valves, Piping and Piping System Components (includes pipe, pipe fittings, valves, pumps, compressors, gauges, and all other pressurized components not listed in the above categories).

The systems and components indicated below are those for this project which at GSFC are specifically considered to be PV/S, and are subject to the requirements of this specification section:

High pressure and medium pressure steam and condensate systems and components, including all pressure vessels, flexible hose, expansion joints, relief valves, piping and piping system components, which have an operating pressure greater than 100 kilopascals (gauge).

1.4 DOCUMENTATION FOR PRESSURE VESSELS AND PRESSURIZED SYSTEMS

Prior to initial operation of pressure vessels and pressurized systems, assemble the following information into a single, organized document, and submit as the PV/S Certification Records for that pressure vessel or system.

No pressure vessel, pressurized system, or components shall be pressurized or operated until the Government has approved this data and certified the system to be safe to operate.

1.4.1 Manufacturer's Drawings

For components such as pressure vessels, vacuum vessels, piping, and expansion joints, the drawings shall be either the certified shop fabrication drawings or as-built drawings. The drawings shall contain the following:

a. Manufacturers name
b. Date of manufacture
c. Identification of component
d. Configuration
e. Dimensions and details of construction
f. Design and operating conditions
g. Design code or design basis
h. Thicknesses
i. Corrosion allowance
j. Identification of materials and design properties
k. Efficiency of joints
l. Nondestructive examinations
m. Types of tests (e.g., hydrostatic, pneumatic)

For components such as pumps, compressors, valves, gauges, and relief devices, the drawings shall be the certified outline and cross-sectional drawings showing information such as make, model number, materials of construction, and design and operating data.

1.4.2 Design Calculations

Design calculations for components such as pressure vessels, vacuum vessels, and piping shall include pressure, temperature, wind, seismic, deadload, and any other applicable loadings. They shall specify the applicable code, standard, or other design basis.

1.4.3 Manufacturer's Data Report

Manufacturer's data reports shall be furnished for all components built to the rules of the ASME Boiler and Pressure Vessel Code, as illustrated in the applicable sections of the code. The equivalent information shall be furnished for components such as pumps, compressors, valves, gauges, and relief valves; data shall include performance curves, and shop test reports (e.g., hydrostatic test, performance test, net positive suction head test, mechanical running test, relieving capacity, and calibration test.)

1.4.4 Mill Test Reports

Mill test reports shall be as furnished by the material manufacturer for the material supplier to certify compliance with specifications. They shall contain information such as material manufacturer, purchaser,

material specification, description of material furnished, heat number, chemical and mechanical properties, and results of test. These shall be furnished for all materials except those that are not necessary as identified in ASME BPV VIII Div 1, Paragraphs UG-ll (a) and UC-ll (c).

1.4.5 Welding Procedure and Procedure Qualification Records

Welding procedure and procedure qualification test records shall be as prepared and furnished by the manufacturer. They shall describe the welding procedure and record the test results obtained in welding procedure and welder performance qualifications and the results of examinations of welding operators. These shall be as illustrated in ASME BPV IX.

1.4.6 Record of Nondestructive Examinations

Nondestructive examinations reports shall be prepared by the manufacturer. The minimum requirements for the reports are given in the applicable sections of ASME BPV V.

1.4.7 Pressure Test Record

The pressure test record shall be prepared and furnished by the manufacturer.

1.4.8 Record of Post-Weld Heat Treatment

This document shall be prepared by the company performing the heat treatment and shall be furnished by the component manufacturer. It shall show rates of heating and cooling, holding temperature, and length of time at holding temperature.

1.4.9 Facsimile of Nameplate Stamping

This document shall be prepared by the manufacturer, and shall be a pencil rubbing of the actual nameplate as stamped.

1.4.10 Record of Impact Test

This document shall be furnished either by the material manufacturer of the component manufacturer, It shall contain the applicable specification, test procedure used, and results of all tests.

1.4.11 Record of Heat Treatment

This documentation of material heat treatment shall be provided only when such heat treatment is done by, or under the control of, someone other than the material supplier. It shall be attached as a supplement to the appropriate mill test report.

1.5 QUALITY ASSURANCE

1.5.1 Personnel Qualifications

This specification contains the minimum requirements for qualifying welding procedures, welders, and welding operators for making and inspecting welds in mechanical fabrications of carbon steel, low alloy steel, extra-high-strength quenched and tempered low alloy steels, and austenitic stainless steel materials.

1.5.2 Pressure Vessels Qualification

Qualification documents WPS or BPS, PQR and WPQ or BPQ as applicable shall be in accordance with ASME BPV IX.

1.5.3 Piping Qualifications

Qualification documents, WPS or BPS, PQR and WPQ or BPQ as applicable shall be in accordance with ASME BPV IX.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 CONSTRUCTION

3.1.1 Pressure Vessels

3.1.1.1 New Construction

Contractor shall meet the fabrication, welding/brazing and inspection requirements of the ASME BPV VIII Div 1 or ASME BPV VIII Div 2.

3.1.1.2 Repairs to Existing Pressure Vessels

Code Stamped Vessels: Contractor shall meet the fabrication, welding/brazing and inspection requirements of NBBPVI-23.

Non-Code Vessels: Contractor shall meet the fabrication, welding/brazing and inspection requirements of NBBPVI-23 with the following exception:

a. It is not necessary that a National Board Code Inspector inspect the work.

b. National Board ("R" Stamp) Code stamping is not required.

3.1.2 Piping

Piping systems shall be fabricated, assembled and welded/brazed/soldered in accordance with ASME B31.9, or ASME B31.1 if size pressure or temperature exceed the limits of ASME B31.9.

3.2 HEAT INPUT REQUIREMENTS

3.2.1 Preheat

Welding shall not be done at ambient temperature below 32 degrees F, or when the surfaces are wet or exposed to rain, snow, or high wind. Temperature of the metals in the area where the welding is to be done shall be not less than 50 degrees F. When the ambient conditions are such that the normal temperature of the base metal is below 50 degrees F, the area surrounding the joint shall be preheated to provide a base metal temperature of 100 degrees F for a distance of at least 3 inches in all directions from the joint to be welded. Preheat shall be in accordance with ASME BPV VIII Div 1 or ASME BPV VIII Div 2 and ASME BPV V.

3.2.2 Interpass

In a multipass weld, the interpass temperature is the temperature of the

weld metal before the next pass is started. Interpass requirements shall be in accordance with ASME BPV VIII Div 1 or ASME BPV VIII Div 2 and ASME BPV V.

3.2.3 Postweld

Weldments shall not be given a postweld heat treatment unless noted in the applicable code qualified/certified welding documentation, WPS, PQR and WPQ.

3.3 INSPECTION/NONDESTRUCTIVE TESTING (NDT)

3.3.1 General

Fabrication/Erection inspection shall be performed prior to assembly, during assembly, during welding and after welding to ensure that materials and workmanship meet the requirements of the contract documents.

Each specified radiograph shall, as a minimum, have the following additional information permanently included in the image:

Agency Weld No. (including repair cycle no.)

Agency drawing No.

Agency View No.

Agency Contract No.

Final interpretation and acceptance of all radiographs of welded joints, with the exception of code stamped pressure vessel welds, will be by the Contracting Officer.

Final acceptance of all welded/brazed joints shall be by the Contracting Officer.

Prior to the Contracting Officer's inspection, all slag and scale shall be removed from all welds. Procedure employed shall not produce notches in either the weld metal or adjacent base metal.

Unacceptable welds shall be immediately repaired and made ready for Government reinspection at no additional cost to the Government.

After weld joints have been satisfactorily completed by the Contractor and accepted by the Contracting Officer, the joint area shall be cleaned to a bright, unpitted, and unscarred surface and then protected in accordance with the contract documents.

3.3.2 Pressure Vessels

3.3.2.1 Test Method

All nondestructive testing shall be performed in accordance with the requirements of ASME BPV V.

3.3.2.2 Acceptance Requirements

Acceptance requirements shall be in accordance with ASME BPV V and ASME BPV VIII Div 2.

3.3.3 Piping

3.3.3.1 Test Method

NDT (Nondestructive Testing) of all piping systems shall be performed in accordance with the requirements of ASME BPV V.

For high pressure (125 psig or above) systems. Not less than 10 percent of all butt welds shall be examined fully by random radiography. Welds to be examined shall be selected to ensure that the work product of each welder or welding operator doing the production welding is included. These welds shall satisfy the acceptance standards of the specified code. If any of the butt welds examined reveals an unacceptable indication, all butt welds welded by that welder(s) shall be examined/accepted by radiography.

3.3.3.2 Acceptance Requirements

High pressure (100 psig) steam and condensate piping systems shall meet the requirements of ASME B31.1.

3.4 PROTECTION OF ADJACENT MATERIALS

Contractor shall sufficiently protect machinery, materials, floor, etc., adjacent to the welding/brazing operations to prevent any damage from these operations.

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DIVISION 15 - MECHANICAL

SECTION 15085

PIPING INSULATION

03/04

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SECTION 15085

PIPING INSULATION
03/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 195	(1995) Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(1995) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 547	(1995) Mineral Fiber Preformed Pipe Insulation
ASTM C 553	(1999) Standard Specification for Mineral Fiber Blanket and Felt Insulation (Industrial Type)
ASTM C 916	(1985; R 1996; Rev E1) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 921	(1989; R 1996) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 579	(1997) Standard Specification for Greige Woven Glass Fabrics
ASTM E 84	(2000; Rev A) Surface Burning Characteristics of Building Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 220	(1999) Standard Types of Building Construction
NFPA 255	(2000) Standard Method of Test of Surface Burning Characteristics of Building Materials

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 3779	(1990; Rev A) Tape Adhesive, Pressure Sensitive Thermal Radiation Resistant

1.2 SYSTEM DESCRIPTION

Section 15003, "General Mechanical Provisions," applies to work specified in this section.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Manufacturer's Catalog Data shall be submitted for the following items:

Adhesives
Coatings
Insulating Cement
Insulating Materials
Jacketing
Tape Materials

PART 2 PRODUCTS

2.1 MATERIALS

Thermal-insulation system materials shall be noncombustible, as defined by NFPA 220. Adhesives, coatings, sealants, facings, jackets, and thermal-insulation materials, shall have a maximum flame-spread index of 25, and a maximum smoke-developed index of 50. These values shall be determined in accordance with ASTM E 84 or NFPA 255. Coatings and sealants shall be nonflammable in their wet state, except those for cellular elastomers.

Adhesives, coatings, and sealants shall have published or certified temperature ratings suitable for the entire range of working temperatures normal for the surfaces to which they are to be applied.

Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either the wet or dry state. Materials shall be asbestos free and conform to the following.

2.1.1 Adhesives

2.1.1.1 Cloth Adhesives

Adhesives for adhering, sizing, and finishing lagging cloth, canvas, and open-weave glass cloth shall be a pigmented polyvinyl acetate emulsion and shall conform to the requirements of ASTM C 916, Type I.

2.1.2 Coatings

2.1.2.1 Outdoor and Indoor Nonvapor-Barrier Finishing

Coatings for outdoor and indoor nonvapor-barrier finishing of insulation surfaces shall be pigmented polymer-emulsion type recommended by the

insulation material manufacturer for the surface to be coated and shall be applied to specified dry-film thickness.

2.1.3 Insulating Cement

2.1.3.1 General Purpose Insulating Cement

General purpose insulating cement shall be mineral fiber and shall conform to ASTM C 195. Composite shall be rated for 1800 degrees F service and shall have a thermal-conductivity maximum of 0.85 Btu by inch per hour per square foot for each degree F temperature differential at 200 degrees F mean temperature.

2.1.3.2 Finishing Insulating Cement

Finishing insulating cement shall be mineral-fiber, hydraulic-setting type conforming to ASTM C 449/C 449M.

2.1.4 Insulation Materials

Insulation conductances shall be maximum values, as tested at any point, not an average. Insulation conductance found by test to exceed the specified maximum shall either be replaced or augmented by an additional thickness to bring it to the required maximum conductance and a complete finishing system.

2.1.4.1 Mineral Fiber Pipe Insulation

Mineral fiber pipe insulation shall conform to ASTM C 547, Type I, molded, for surface temperatures up to 817 degrees F. Thermal conductivity shall be not greater than 0.26 Btu per hour per square foot square per degree F at 68 degrees F.

Pipe fitting insulation shall be molded pipe fitting covering, of materials with the same properties as the pipe insulation, or fittings shall be wrapped with flexible blanket.

Flexible mineral fiber blankets shall conform to ASTM C 553, Type III, for use at temperatures up to and including 418 degrees F. Thermal conductivity shall be not greater than at mean.

2.1.4.2 Calcium Silicate

Calcium silicate shall conform to ASTM C 533, Type I, pipe insulation. Thermal conductivity shall be not greater than at mean.

2.1.5 Jacketing

2.1.5.1 Glass Cloth Jackets

Glass cloth shall be plain-weave glass cloth conforming to ASTM D 579, Style 141 and shall weigh not less than before sizing. Cloth shall be factory applied wherever possible.

Glass reinforcing cloth shall be a leno weave, 26-end and 12-pick thread conservation, with a warp and fill tensile strength of 45 and 30 pounds per inch of width, respectively, and with a weight of not less than 1.5 ounces per square yard. At the Contractor's option, Style 191 leno-weave glass cloth conforming to ASTM D 579 may be provided.

2.1.6 Tape

Glass lagging shall be a knitted elastic cloth specifically suitable for continuous spiral wrapping of insulated pipe bends and fittings and shall produce a smooth, tight, wrinkle-free surface. Tape shall conform to requirements of SAE AMS 3779, ASTM D 579, and ASTM C 921, and shall weigh not less than 10 ounces per square yard.

2.2 PIPING SYSTEMS

Insulation thickness and pipe sizes are in nominal inches.

Requirements specified below are for aboveground piping, not exposed to weather.

2.2.1 Steam Piping, High and Medium Pressure

Insulation shall be mineral fiber with glass cloth jacket, Type T-2. Thickness shall be not less than that given in the following list. Aboveground pipes, fittings, and miscellaneous surfaces shall be insulated. Valve bodies, unions, flanges, strainers and steam traps need not be insulated in concealed locations or unfinished areas, unless indicated on drawings.

PIPE SIZE (INCH)	INSULATION THICKNESS (INCH)
Up to 1	2
Over 1 to 4	2-1/2
over 4	3-1/2

2.2.2 Condensate-Return Piping, High and Medium Pressure

Insulation shall be mineral fiber with glass cloth jacket, Type T-2. Thickness shall be not less than that given in the following list. Aboveground pipes, fittings, and miscellaneous surfaces shall be insulated. Valve bodies, unions, flanges, strainers and steam traps need not be insulated in concealed locations or unfinished areas, unless indicated on drawings.

PIPE SIZE (INCH)	INSULATION THICKNESS (INCH)
Up to 1	2
Over 1 to 4	2-1/2
over 4	3-1/2

PART 3 EXECUTION

3.1 INSTALLATION OF INSULATION SYSTEMS

Contours on exposed work shall be smooth and continuous. Cemented laps, flaps, bands, and tapes shall be smoothly and securely pasted down. Adhesives shall be applied on a full-coverage basis.

Insulation shall be applied only to system or component surfaces that have been tested and approved.

Joints shall be tight with insulation lengths tightly butted against each other. Where lengths are cut, cuts shall be smooth and square and without breakage of end surfaces. Where insulation terminates, ends shall be neatly tapered and effectively sealed, or finished as specified. Longitudinal seams of exposed insulation shall be directed away from normal view.

Materials shall be applied in conformance with the recommendations of the manufacturer.

Surfaces shall be clean and free of oil and grease before insulation adhesives or mastics are applied. Solvent cleaning required to bring metal surfaces to such condition shall be provided.

3.2 SYSTEM TYPES

3.2.1 Type T-2, Mineral Fiber with Glass Cloth Jacket

Piping shall be covered with a mineral-fiber, pipe insulation with factory-attached, presized, white, glass cloth. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than 1-1/2 inches. Jacketing bands for butt joints shall be 3 inches wide.

Exposed-to-view fittings shall be covered with preformed mineral-fiber fitting insulation of the same thickness as the pipe insulation and temporarily secured in place with light cord ties. Impregnated glass lagging tape shall be installed with indoor vapor-barrier on 50 percent overlap basis and the tape shall be blended smoothly into the adjacent jacketing. Additional coating shall be applied as needed, and rubber gloved to a smooth contour. Ends of insulation shall be taped to the pipe at valves 2 inches and smaller. On-the-job fabricated insulation for concealed fittings and special configurations shall be built up from mineral fiber and a mixture of insulating cement and lagging adhesive, diluted with 3 parts water. Surfaces shall be finished with glass cloth or tape lagging.

Valves 2-1/2 inches and larger and all flanges shall be covered with preformed insulation of the same thickness as the adjacent insulation.

Exposed-to-view insulation shall be finished with a minimum 6-mildry-film thickness of nonvapor-barrier coating suitable for painting.

In lieu of materials and methods specified above, fittings may be wrapped with a twine-secured, mineral-wool blanket to the required thickness and covered with premolded polyvinylchloride jackets. All jacket ends shall be held in place with ANSI 300 series corrosion-resistant steel straps, 15 mils thick by 1/2 inch wide. Fitting insulation shall be thermally equivalent to pipe-barrel insulation to preclude surface temperatures detrimental to polyvinylchloride.

3.2.2 Type T-5, Calcium Silicate with Glass Cloth Jacket (Piping)

Piping shall be covered with a calcium-silicate pipe insulation with factory attached and presized, white, glass cloth. Jackets shall be field

applied when required. Jackets, jacket laps, flaps, and bands shall be securely cemented in place with vapor-barrier adhesive. Jacket overlap shall be not less than 1-1/2 inches. Jacketing bands for butt joints shall be 4-inches wide. Fittings shall be fabricated from segmented pipe barrel sections bedded in general purpose insulating cement and wired in place. Voids shall be filled with general purpose insulating cement with not less than 1/4-inch thick, final coating. Glass lagging tape shall be impregnated with lagging adhesive, wrapped with a 50-percent overlap, and be blended smoothly into adjacent jacketing. Additional adhesive shall be applied as needed and rubber-gloved to a smooth contour.

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15183

STEAM AND CONDENSATE SYSTEMS

03/01

SECTION 15183

STEAM AND CONDENSATE SYSTEMS
03/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.1	(2001) Power Piping
ASME BPV I	(2001) Boiler and Pressure Vessel Code; Section I, Power Boilers
ASME BPV VIII Div 1	(2001) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels, Division 1, Basic Coverage

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 1139	(1988; R 1998) Standard Specification for Steam Traps and Drains

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application

1.2 GENERAL REQUIREMENTS

Section 15003, "General Mechanical Provisions" and Section 15050, "Basic Mechanical Materials and Methods," apply to this section, with the additions and modifications specified herein.

This section includes steam piping from the high pressure main to the drum heaters, and condensate piping from the heaters to the condensate tank.

All installation or modification of high pressure steam and condensate systems shall comply with the requirements of Section 15055, "Welding and Pressure Vessels/Systems".

1.2.1 Classes and Maximum Working Pressures

Equipment, piping, and piping components shall be suitable for use under the maximum working pressure indicated. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications.

1.2.2 Welding

Welding shall be performed in accordance with Section 15055, "Welding and Pressure Vessels/Systems".

1.3 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittals."

SD-02 Shop Drawings

Submit fully detailed fabrication and installation drawings for steam boiler modifications and attachments and drum heaters.

SD-03 Product Data

Manufacturer's Data shall be submitted for the items listed below. Data shall include preprinted catalog data, plus any supplemental data required to provide sufficient detail to show full compliance with the specifications. Data shall include statements of compliance with indicated standards, equipment outline and dimension drawings, and performance data tables or curves as applicable.

Valves
Traps
Safety Valves
Drum Heaters
Pipe and Fittings

SD-06 Test Reports

Field Test Reports shall be submitted for the items listed below. Each report shall be properly identified, including description of methods and instrumentation used, compliance with specified or recognized test standards, all test data and results, analysis and interpretation of test results, and indicate whether the material, product, or system has passed or failed the test. Reports shall be signed by an authorized official of the contractor, by an authorized official of the testing laboratory or agency (if applicable), and by the Government inspector who witnessed the test.

Steam and condensate piping tests
Steam and condensate system startup and operation tests

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals, shall be submitted for the following items, in accordance with Section 01770, "Contract Closeout". Manuals shall include approved submittal data, manufacturer's operation, maintenance and repair instructions, spare parts lists.

Approved Submittals for all Material and Equipment
Start-up, Operation and Shutdown Instructions for Drum Heaters
Approved Test Reports
As-Built Drawings

SD-11 Closeout Submittals

PV/S Certification Records, as defined in 15055, "Welding and Pressure Vessels/Systems" shall be submitted for high and medium pressure systems and components, for approval and Certification prior to pressurization and operation.

PART 2 PRODUCTS

2.1 PIPE AND PIPE SYSTEM

2.1.1 High Pressure Steam Piping System

High pressure system operating pressure is 690 kilopascal at 170 degrees C.

High pressure steam piping and fittings shall be type BCS-150, Schedule 40, as specified in Section 15050, "Basic Mechanical Materials and Methods".

2.1.2 High Pressure Condensate Return Piping

High pressure condensate return piping and fittings shall be type Type BCS-150, Schedule 80, as specified in Section 15050, "Basic Mechanical Materials and Methods".

2.1.3 Valves

Unless otherwise indicated, valves shall conform to the following paragraphs. End connections shall conform to specified pipe and fitting type. Valves shall be of the types indicated below, as specified in Section 15050, "Basic Mechanical Materials and Methods".

2.1.3.1 Gate Valves

High Pressure Steam and Condensate: Type GAV-150.

2.1.3.2 Globe and Angle Valves

High Pressure Steam and Condensate: Type GLV-150 and ANV-150.

2.1.3.3 Check Valves

High Pressure Steam and Condensate: Type CV-150.

2.1.3.4 Safety Valves

Pressure relief valves shall be of the size, pressure rating and capacity as indicated.

Pressure-relief valve shall be constructed, labeled, and installed in accordance with ASME BPV I. Relieving capacity shall be as specified by the referenced publication. Valves shall be of nonferrous construction, complete with test lever.

2.1.4 Miscellaneous Pipeline Components

2.1.4.1 Steam Traps

Traps shall be of the type, pressure rating, and capacity indicated.

Trap bodies and components shall have a primary working steam pressure (wsp)-rating equal to or in excess of the maximum wsp of the steam system to which applied. Traps shall comply with ASTM F 1139.

Float and thermostatic traps shall have AISI 300 series corrosion-resistant steel, heliarc-welded floats and operating mechanisms, and hardened, 13 percent chrome corrosion-resistant steel seats and valves.

Thermostatic elements shall be balanced pressure type, with corrosion-resistant alloy bellows charged with a fluid that will provide most rapid response to changes in temperature.

Bellows shall be suitable for service with condensate having a pH of 6.0.

Traps shall be designed to permit removal and replacement of all operating and wearing parts without disturbing piping connections to trap body.

Bellows shall be designed to permit removal while hot without overexpansion and shall be shielded from direct blast of steam and condensate.

Bodies shall be fitted with drain plug.

Traps shall have permanent external identification of service rating and orifice size.

2.1.4.2 Strainers

Strainers shall be the type indicated below as specified in Section 15050, "Basic Mechanical Materials and Methods".

High Pressure Steam and Condensate: Type HTP

2.1.4.3 Hangers, Supports, Spacing Requirements, and Attachments

Supporting elements shall be in accordance with Section 15050, "Basic Mechanical Materials and Methods".

MSS SP-58 and ASME B31.1 for materials, design, and manufacture. MSS SP-69 for selection and application.

2.2 INSULATION

Steam and condensate piping systems and equipment shall be insulated in accordance with Section 15085, "Piping Insulation".

PART 3 EXECUTION

3.1 INSTALLATION

Work material and equipment into a complete, convenient, and economical system or systems; and provide apparatus, parts, materials, and accessories which are necessary to accomplish this result.

3.1.1 Piping

Fabricate, assemble, weld, solder, braze, and install piping and pipe system in accordance with Section 15050, "Basic Mechanical Materials and Methods", and ASME B31.1 and as further qualified herein. Piping shall follow the general arrangement shown.

Provide adequate clearances from walls, ceilings, and floors to permit the welding of joints; at least 6 inches for pipe sizes 4 inches and smaller, 10 inches for pipe sizes larger than 4 inches, and in corners provide sufficient clearance to permit the welder to work between the pipe and one wall. Make provision for expansion and contraction of pipe lines. Do not bury, conceal, or insulate piping until it has been inspected, tested, and approved. Do not conceal piping in walls, partitions, underground, or under the floor except as indicated. Where pipe passes through building structure, do not conceal pipe joints, but locate where they may be readily inspected and not weaken building structure. Run insulated pipe as shown and as required with sufficient clearance to permit application of insulation.

Use long radius ells wherever possible to reduce pressure drops. Pipe bends may be used in lieu of welding fittings where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and shall be free from any appreciable flattening, wrinkling, or thinning of the pipe. Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used. Make branch connections to the top of mains with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run.

Install piping connected to equipment to provide flexibility for thermal stresses and for vibration. Support and anchor pipe so that strain from weight and thermal movement of piping is not imposed on the equipment.

3.1.1.1 Welding, Brazing and Soldering

a. Welding, Brazing and Soldering of Piping: Welding of joints in piping, butt welds, fillet welds, bends, loops, offsets, and preparation and cleaning of pipe for welding, brazing, or soldering, shall be in accordance with ASME B31.1 and the requirements of Section 15055, "Welding and Pressure Vessels/Systems".

3.1.1.2 Hangers and Supports

Horizontal and vertical piping attachments shall conform to Section 15050, "Basic Materials and Methods", ASME B31.1, and MSS SP-58.

3.1.1.3 Grading and Venting of Pipe Lines

Unless otherwise indicated, install horizontal lines of steam and condensate return piping to grade down in the direction of flow with a pitch of not less than 2 mm per meter (0.2%) for steam, and 4mm per meter (0.4% for condensate. When counterflow of condensate within the steam pipe occurs in a portion of a pipeline, pitch up in the direction of steam flow a minimum of 6 inches per 100 feet (0.5%) and increase pipe diameters by one standard pipe size or as indicated on drawings. Branch lines less than

3 meters in length may be sloped back to the main at 5 mm per meter (0.5%) without increasing size. Eccentric reducers shall be used in all horizontal piping to maintain a constant pitch. Air vents shall be provided at the highest point of any vertical riser.

3.1.1.4 Penetrations

Piping penetrations through floors, walls, roofs, and partitions shall be in accordance with Section 15050, "Basic Mechanical Materials and Methods".

3.1.1.5 Unions and Flanges

Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus, and as indicated. Provide a union for each threaded end valve. Use unions on piping smaller than 2 inches in diameter, and use flanges on piping 2 inches and larger in diameter. Provide dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous to non-ferrous connections. Dielectric fittings shall utilize a non-metallic filler which will prevent current flow. The spacer shall be suitable for the pressure and temperature of the service.

3.1.1.6 Traps and Connections

Traps shall be of the type and capacity for the service as indicated, "Steam Traps", and shall be properly supported and connected. Install traps with a dirt pocket and strainer between it and the piping or apparatus it drains, and a gate valve and union on each side. Where indicated, to maintain in continuous service apparatus or piping which is to be drained, provide a three-valve bypass so that the trap may be removed and repaired and condensate may drain through the throttled bypass valve. Provide a check valve on the discharge side of the trap whenever the trap is installed for lift or operating against a back pressure, or discharges into a common return line. Provide test connections on the discharge side of the high and medium pressure traps. The test connection shall include a 1/2 inch globe valve with uncapped nipple. At all low points of steam piping provide full-size drip leg with blowdown valve and trap. Minimum length of drip leg (from bottom of main to level of trap) shall be .

3.1.1.7 Connections for Future Equipment

Locate capped or plugged outlets for connections to future equipment as indicated.

3.1.1.8 Trap Installation

Piping from equipment outlet to trap shall include a vertical section, the full size of the outlet connection, with the trap inlet located a minimum of 12 inches below the equipment outlet unless otherwise indicated, and the bottom of the vertical pipe capped or plugged to form a dirt pocket a minimum of 6 inches deep below the trap connection. Trap shall be installed with strainer, valves and unions as described above.

3.1.2 Valves

3.1.2.1 General

Install valves in conformance with ASME B31.1, ASME BPV VIII Div 1, and as

required herein, at the locations indicated and elsewhere as required for the proper functioning of the system. Install valves in positions accessible for operation and repair.

3.1.2.2 Globe Valves

Install globe valves so that the pressure shall be below the disk. Install globe valves with the stems horizontal on steam and exhaust lines.

3.1.3 Strainers

Provide strainers with meshes suitable for the services where indicated, and where dirt might interfere with the proper operation of valve parts, orifices, and moving parts of equipment. Provide globe valves for blowdown.

3.1.4 Cleaning of System

As installations of the various system components are completed, clean before final closing. Remove foreign matter from equipment and surrounding areas. Preliminary or final tests shall not be performed until the cleaning is approved.

Thoroughly clean each section of pipe, fittings, and valves of foreign matter before erection. Before placing in position, clean the inside of black steel pipe by rapping along its full length to loosen sand, mill scale, and other foreign matter; pipe 2 inches and larger shall have a wire brush of a diameter larger than that of the inside of the pipe drawn through its entire length several times. Before final connections are made to the apparatus, thoroughly wash out the piping interior with water. Blow out steam piping with high-pressure steam, if available, or compressed air, removing rust, oil, chips, sand, and other material. Plug or cap open ends of mains during shutdown periods. Do not leave lines open at any place where any foreign matter might accidentally enter pipe.

3.2 PRESSURE VESSELS AND PRESSURIZED SYSTEMS (PV/S) CERTIFICATION

All installation or modification of high pressure and medium pressure steam and condensate systems shall comply with the requirements of Section 15055, "Welding and Pressure Vessels/Systems", and PV/S Certification Records shall be prepared as indicated in that section. This data must be submitted and approved, and the system or components Certified by the Government, prior to pressurization and operation.

3.3 FIELD TESTS AND INSPECTIONS

3.3.1 Field Inspections

Inspect piping system prior to initial operation, for conformance to drawings, specifications, and ASME B31.1. Equipment, material, or work rejected because of defects or non-conformance with drawings, specifications, and ASME B31.1 shall be replaced or corrected by the Contractor, as directed by the Contracting Officer.

3.3.2 Field Tests

Conduct the following tests after completion of the piping installation and prior to installing insulation, or initial operation.

3.3.2.1 Piping System

Test piping system hydrostatically using water not exceeding 100 degrees F. Conduct tests in accordance with the requirements of ASME B31.1 and as follows. Test the piping system after the lines have been cleaned as herein specified and before any insulation covering has been applied. Test piping system at 1 1/2 times the system pressure or 50 psig whichever is greater. Before performing tests, remove or valve off from the system, gauges, traps, and other apparatus which may be damaged by the test pressure. Install a calibrated test pressure gauge in the system to observe any loss in pressure. Maintain the required test pressure for not less than 8 hours with no loss of pressure. Leaks shall be corrected and re-tested.

3.3.2.2 Start-Up and Operational Test

Start-up the system and initially operate with components operating. During the test, periodically clean the various strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of water and steam occur when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence.

3.4 OPERATIONAL READINESS REVIEW (ORR)

Provide Operational Readiness Review (ORR) in accordance with Section 01770, "Contract Closeout", for system including new valves, traps, pumps, converters, and controls.

ORR shall include a complete walk-through of the system, identifying locations of all items listed above, and all connected equipment.

-- End of Section --

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DIVISION 15 - MECHANICAL

SECTION 15561

CENTRAL STEAM GENERATING SYSTEM - BOILER MODIFICATIONS

08/94

-- End of Section Table of Contents --

SECTION 15561

CENTRAL STEAM GENERATING SYSTEM - BOILER MODIFICATIONS
08/94

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ASME INTERNATIONAL (ASME)

ASME B31.1	(2001) Power Piping
ASME BPV I	(2001) Boiler and Pressure Vessel Code; Section I, Power Boilers
ASME BPV IX	(2001) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBPVI)

NBBPVI-23	(1998) National Board Inspection Code

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detailed Drawings

Detail drawings of the drum heaters and associated boiler connections and piping. Drawings shall indicate clearances required for maintenance and operation and shall also contain equipment layout and anchorage, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

SD-03 Product Data

Manufacturers's Certification of Compliance with the specified standards, materials and ratings, for the drum heaters and associated boiler connections and piping.

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Pressure Testing Procedures

Pressure Testing Procedures, shall be submitted, and testing shall not proceed until approved. Include a procedure for cleaning prior to connecting tubing and piping to instruments and prior to pressure testing, test equipment use, and cleaning after completion of testing and installation. Repair procedure for piping and tubing materials failing pressure tests.

Test Schedule

A written schedule, shall be submitted, and testing shall not proceed until approved.

SD-06 Test Reports

All Testing

Test reports in booklet form showing field tests performed to prove compliance with the specified standards, materials, ratings, and performance criteria, upon completing and testing the installed system.

1.3 GENERAL REQUIREMENTS

1.3.1 Verification of Dimensions

The Contractor shall become familiar with details of the work, verify dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.2 Welding

Steam piping between the boiler and the second stop valve shall be welded and stamped in accordance with ASME BPV I. Other piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Welding and nondestructive testing procedures are specified in Section 15055 WELDING AND PRESSURE VESSELS/SYSTEMS.

1.3.3 Use of Asbestos Products

Products which contain asbestos are prohibited. This prohibition includes items such as packings or gaskets, even though the item is encapsulated or the asbestos fibers are impregnated with binder material.

PART 2 PRODUCTS

2.1 BOILERS AND APPURTENANCES

2.1.1 Construction

Modifications to boilers shall be built and stamped in accordance with ASME BPV I, and as specified.

2.2 BOILER FITTINGS AND APPURTENANCES

2.2.1 Design Pressure and Installation

Boiler fittings and appurtenances suitable for a steam design pressure of 250 psig @ 406 F (sat), and operating pressure of 100 psig @338 F (sat), shall be installed with each boiler in accordance with ASME BPV I.

PART 3 EXECUTION

3.1 INSTALLATION

3.2 PAINTING AND FINISHING

3.2.1 Field Painting

Painting required for surfaces not otherwise specified, shall be to match existing adjoining surfaces..

3.3 TESTING AND INSPECTING

3.3.1 Boilers

General: Contractor shall submit a written Pressure Testing Procedure and Test Schedule to Contracting Officer for approval prior to beginning tests.

3.3.1.1 Hydrostatic Tests

Following modification, each boiler and associated piping shall be tested hydrostatically. Following the installation of piping and boiler house equipment, but before the application of any insulation, hydrostatic tests shall be made and the system shall be proved tight under gauge pressure of 1-1/2 times the working pressure specified and not less than the following:

Low pressure lines 40 psig

Medium pressure lines 60 psig

High pressure steam lines 150 psig

Boiler feed lines 225 psig

The boilers shall be tested and the piping connections inspected by a NBBPVI -23 commissioned boiler inspector for the purpose of determining compliance with requirements of ASME BPV I. The Contracting Officer shall be supplied with a certificate of compliance for each boiler.

-- End of Section --